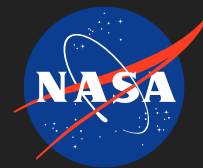


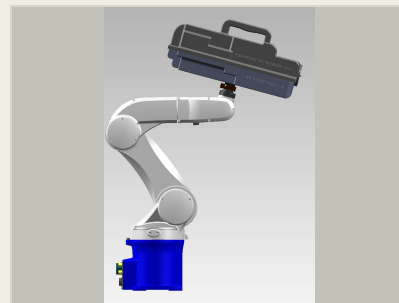
Development of Non-Contact Trace Contamination Detection Methods and Instrumentation for Spacecraft Cleaning Validation Using Deep UV Chemical Imaging, Phase I

Completed Technology Project (2015 - 2015)



Project Introduction

This proposal addresses the need for advanced analytical methods and instrumentation to detect trace levels of chemical and biological contaminants directly on spacecraft and related surfaces to comply with Contamination Control and Planetary Protection requirements in an effort to preserve sample science integrity for life detection investigations on Europa, Enceladus, Mars, etc. The proposed methods employ non-contact deep UV Raman and fluorescence chemical imaging and mapping methods to avoid the need for any contact with spacecraft and related surfaces. The method eliminates the use of traditional sample collection methods such as swabs, wipes, or other methods, which have been shown to back-contaminate spacecraft surfaces as well as collected samples. Raman and fluorescence spectroscopy with excitation in the deep UV below 250 nm enables separation of the spectral regions of both Raman and fluorescence emissions, enabling collection of Raman emissions without obscuration by fluorescence from chemicals of interest as well as many spacecraft materials and from trace organic contamination within field of view of the Raman detection optics. This cannot be accomplished with excitation at longer wavelength including 263 nm or 266 nm from 4th harmonic Nd based lasers. Combining Raman and fluorescence methods in the deep UV enhances the ability to detect and identify the trace chemical or biological materials on these surfaces and have a proven ability to detect biological and other particles and materials on surfaces less than 1 pg, the mass of a single bacterial spore, with dimensions as small as 200 nm. These methods were first developed under funding from NASA Planetary Protection, but were advanced by contracts with several Department of Defense organizations well as commercial developments with both Pfizer Pharmaceutical and DuPont for chemical and biological cleaning validation of their manufacturing equipment.



Development of Non-Contact Trace Contamination Detection Methods and Instrumentation for Spacecraft Cleaning Validation Using Deep UV Chemical Imaging, Phase I

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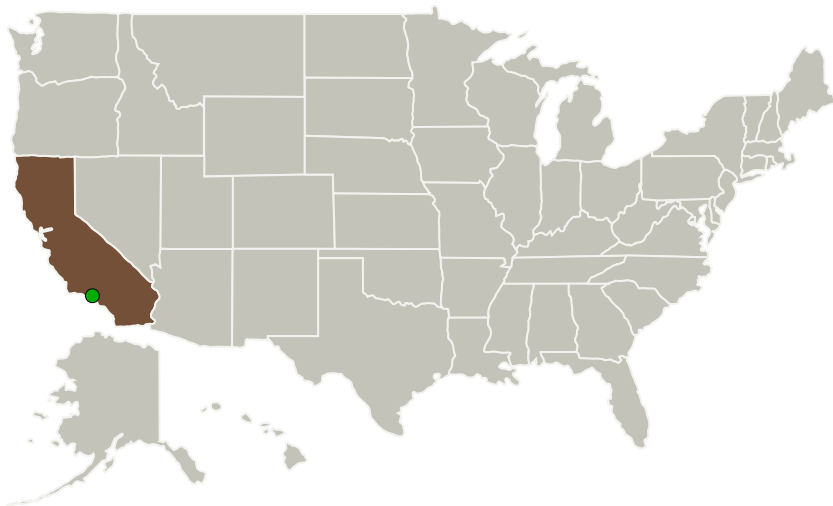
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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Photon Systems, Inc.	Lead Organization	Industry	Covina, California
● Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations

California

Project Transitions

▶ **June 2015:** Project Start

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Photon Systems, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

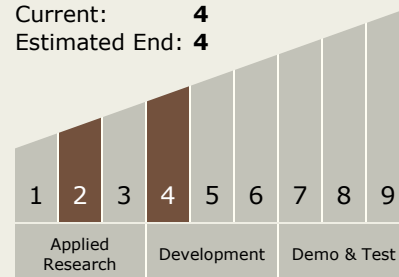
Carlos Torrez

Principal Investigator:

William F Hug

Technology Maturity (TRL)

Start: 2
Current: 4
Estimated End: 4



Development of Non-Contact Trace Contamination Detection Methods and Instrumentation for Spacecraft Cleaning Validation Using Deep UV Chemical Imaging, Phase I

Completed Technology Project (2015 - 2015)



✓ **December 2015:** Closed out

Closeout Summary: Development of Non-Contact Trace Contamination Detection Methods and Instrumentation for Spacecraft Cleaning Validation Using Deep UV Chemical Imaging, Phase I Project Image

Closeout Documentation:

- Final Summary Chart Image(<https://techport.nasa.gov/file/138934>)

Images



Briefing Chart Image

Development of Non-Contact Trace Contamination Detection Methods and Instrumentation for Spacecraft Cleaning Validation Using Deep UV Chemical Imaging, Phase I
(<https://techport.nasa.gov/image/128644>)

Technology Areas

Primary:

- TX07 Exploration Destination Systems
 - └ TX07.3 Mission Operations and Safety
 - └ TX07.3.5 Planetary Protection

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System